

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

Amendments to the Specification:

Please replace paragraph [0003] with the following amended paragraph:

[0003] The Invention relates to fluorescent discharge lamps, and more particularly, to a multi-tube fluorescent discharge lamp which ~~is constructed of~~ construct multiple glass tubes of different caliber in coaxial structure, ~~[[the]] both [[sides]] ends of the inner most tube are connected to a cathode respectively[[.]].~~ By ~~[[by]] isolating, perforating and blocking the discharge path, forming successive to form a succession of interconnected~~ discharge chambers, and coating fluorescent material on surface of the discharge tubes. Such an ~~[[The]]~~ Invention can then have more fluorescent area than a conventional fluorescent lamp of ~~[[the]]~~ similar size and have higher lumen as well as power ~~transfer factor~~ conversion efficiency. Compared By comparing with the power consumption of a conventional fluorescent discharge lamp, ~~the Invention it is~~ therefore has higher luminous flux.

Please replace paragraph [0005] with the following amended paragraph:

[0005] ~~Generally[[.]]~~ A conventional fluorescent discharge lamp generally is ~~uses one~~ straight or ~~[[round]]~~ circular tube type. ~~[[To]] In order to minimize the size and [[to]] increase the illumination luminosity, there is a kind of compact fluoreseent discharge lamp that the straight straight-shaped tube is bent into a wreath or U type for thin tube. Alternatively[[.]] Even in some cases, couples of short straight fluorescent tubes are aligned and connected in parallel, on the On both terminations ends of the tube, it is connected with a cathode tungsten filament [[that]] coated with oxide such as Ba, Sr and Ca. In the discharge tube, it is in a state of vacuum and with little Hg and Ar[[.]] which helps to facilitate the discharge process.~~

Please replace paragraph [0006] with the following amended paragraph:

[0006] The cross-section of conventional fluorescent lamp tubes is usually a round ~~eress-section~~ shape and only one layer of fluorescent material such as phosphor is coated on the surface of the tube inside. When the cathodes on both ~~[[sides]]~~ ends of the tube ~~[[is]] are started-up~~ triggered by current and high-voltage power is applied ~~to the cathodes on both sides of tube, the electron is~~ electron are released between from the two cathodes ~~and make, causing the tube [[glow]] glows and discharge discharges.~~ The gaseous Ar and Hg ~~[[vapor]]~~ molecules are also stimulated to ~~[[create]]~~ form plasma~~[[.]]. Its the ion ions~~ and ultraviolet

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

rays also impact the phosphor[[]], ~~so that the potential energy is transferred into light from the phosphor~~ The light is coming from conversion of energy potential.

Please replace paragraph [0007] with the following amended paragraph:

[0007] Because [the] cross-section area of a round tube is larger than that of any shape, the average density of electronic flux ~~of the round tube~~ inside is lower than in other shape of tube kinds. Furthermore, the electronic flux on the discharge path is concentrated nearby the axis of the discharge tube[[]], ~~whereas the density of the electronic flux nearby the surface of the discharge tube inside gets lower~~ is low.

Please replace paragraph [0008] with the following amended paragraph:

[0008] Therefore, the luminous flux in a round tube can not be enhanced proportionally in proportion to raise by increasing the diameter ~~of the tube~~ to expand the area of phosphor[[]]. Much [much] of energy nearby the axis in the discharge tube will be depleted and ~~transfer~~ converted into heat[[]] and the transferring conversion factor of the lumen (Lm) and Watt (W) remains ~~not high enough~~ insufficient.

Please replace paragraph [0009] with the following amended paragraph:

[0009] Although there is another kind of lamp ~~which build in a~~ with [lot] lots of segmented ~~built-in~~ tubes and coated with phosphor to increase the ~~illuminant~~ luminous fluorescent area, but ~~the lamp~~ it does not ~~forming~~ form a succession of interconnected ~~a successive~~ discharge path[[]], ~~therefore~~ Therefore, it ~~does not guarantee~~ neither a stable discharge path or equable plasma status is not guaranteed, nor an adequate and complete ~~illumination~~ luminescent of fluorescent [layer] layers is excited in the discharge tube, because the discharge path ~~proceeds in~~ takes the shortest distance.

Please replace paragraph [0010] with the following amended paragraph:

[0010] Moreover, due to the narrow spectrum of conventional fluorescent discharge lamp, the color-rendering index (Ra) is low and the color temperature (K) is a bit high ~~which therefore causes~~ causing the illuminated object unable to reveal its colors. ~~Besides~~ In addition, [for] because the cathode on both [sides] ends of the conventional fluorescent discharge lamp is hit by ~~electron~~ electrons, the tungsten filament is then vaporized to [be] become black and it pollutes the fluorescent layer of the tube, ~~hence reduces~~ reducing the ~~illumination~~ luminous efficiency of the fluorescent layer as well as the life cycle of the fluorescent discharge lamp.

Please replace paragraph [0011] with the following amended paragraph:

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

[0011] This Invention is a multi-tube fluorescent discharge lamp; the design concept of the Invention is ~~constructed~~ made of multiple discharge glass tubes of different ~~caliber~~ calibers in a coaxial structure. By isolating, perforating and blocking the discharge path, and applying phosphor on the surface of the discharge tubes, this creates a thin and transparent film of fluorescent coating ~~is then created~~, allowing the light of the inner tubes to pass through each of the coatings to the outside of the lamp. In addition, a pair of ~~cathodes~~ as hot or cold cathodes helps the electronic flux in the vacuum to be ~~accelerated~~ accelerate and hit the Hg molecule, which ~~[[is]]~~ then ~~stimulated~~ to create plasma. The coating of the fluorescent on the inner layer surface of the discharge tube is ~~impacted~~ hit by electron ion and ~~UV rays and then to emits~~ emit light. Under the same power rate and with the same lamp volume of lamp, the tubes of the multi-tube fluorescent discharge lamp aligned in a coaxial structure have a smaller cross-section area than that of a conventional fluorescent discharge lamp so that this Invention can to allow higher density of electron flux to pass through the discharge path in the tubes. Therefore, the high-density electron ion has better stimulating effects on the fluorescent coating and the ~~illuminant~~ luminous fluorescent area is larger than conventional fluorescent discharge lamp, both of these advantages ~~increasing~~ increase the luminous flux.

Please replace paragraph [0012] with the following amended paragraph:

[0012] Compared to conventional fluorescent discharge lamp of the same power rate, this Invention is characterized by higher luminance, lower consumption of ~~electric power~~ electricity and lower heat rate. Moreover, because the electric flux of the Invention is less than that of a conventional fluorescent discharge lamp, the vaporization caused by electric flux hitting the cathode ~~[[gets]]~~ is slower and the life cycle of the cathode is longer ~~accordingly~~ than that of conventional fluorescent discharge lamps. It is also feasible to apply a ringed cathode to increase the surface area of the hitting ~~[[of]]~~ electron flux and then disperse the hitting, so that the oxide material on the surface of the cathode can be protected from rapid consumption. ~~[[By]]~~ In this way, ~~[[the]]~~ multi-tube fluorescent discharge lamp can outlive conventional fluorescent discharge ~~[[lamp]]~~ lamps.

Please replace paragraph [0013] with the following amended paragraph:

[0013] ~~[[The]]~~ A multi-tube fluorescent discharge lamp ~~whose with a coated surface is coated with of various fluorescent material of materials has different eolors temperature color temperatures~~. The fluorescent material, being when stimulated, can release ~~fluorescence of~~ different spectrum and create special colors after mixing. Alternatively it can include a wider spectrum to improve the color temperature (K) as well as color-rendering index (Ra) to be close to the ~~[[sun]]~~ sun's spectrum.

Please replace paragraph [0014] with the following amended paragraph:

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

[0014] The multi-tube fluorescent discharge lamp is designed ~~[[in]]~~ with coaxial structure, aiming to achieve special ~~colorful~~ color luminance or a balanced spectrum range of light by way of filtering the luminance released from the transparent discharge glass tube of different colors.

Please replace paragraph [0017] with the following amended paragraph:

[0017] ~~FIG.2 to FIG.9 are~~ is a cross-sectional views and end views showing a step-by-step process of fabrication of a three-tube fluorescent discharge lamp of a first embodiment.

FIG.3 is a cross-sectional views and end views showing a step-by-step process of fabrication of a three-tube fluorescent discharge lamp of a first embodiment.

FIG.4 is a cross-sectional views and end views showing a step-by-step process of fabrication of a three-tube fluorescent discharge lamp of a first embodiment.

FIG.5 is a cross-sectional views and end views showing a step-by-step process of fabrication of a three-tube fluorescent discharge lamp of a first embodiment.

FIG.6 is a cross-sectional views and end views showing a step-by-step process of fabrication of a three-tube fluorescent discharge lamp of a first embodiment.

FIG.7 is a cross-sectional views and end views showing a step-by-step process of fabrication of a three-tube fluorescent discharge lamp of a first embodiment.

FIG.8 is a cross-sectional views and end views showing a step-by-step process of fabrication of a three-tube fluorescent discharge lamp of a first embodiment.

FIG.9 is a cross-sectional views and end views showing a step-by-step process of fabrication of a three-tube fluorescent discharge lamp of a first embodiment.

Please replace paragraph [0024] with the following amended paragraph:

[0024] ~~FIG.16 and FIG.17 are~~ is a cross-sectional view to follow the FIG.9 showing a step-by-step process of fabrication of the three-tube fluorescent discharge lamp of the first embodiment.

FIG.17 is a cross-sectional view to follow the FIG.9 showing a step-by-step process of fabrication of the three-tube fluorescent discharge lamp of the first embodiment.

Please replace paragraph [0033] with the following amended paragraph:

Appl. No. 09/681,524
 Amdt. dated 09/14/2003
 Reply to Office action of 03/14/2003

[0033] According to Figure 1, illustrates a conventional fluorescent discharge lamp. The discharge tube 8 is a straight glass tube~~[[.]], on both sides of the tube are the~~ One cathodes 26, ~~with its whose~~ electrode 28 ~~[[are]]~~ connected to the terminal 42 ~~[[of]]~~ on the tube base 40~~[[.]],~~ is located at each end of the tube. The figure ~~explains~~ shows clearly that there is only one phosphor layer 18 on the inside surface of the tube ~~inside~~. In addition, because the density of electronic flux is higher at nearby the axis of the discharge tube ~~is higher than that the~~ electronic flux nearby at the phosphor layer 18 ~~of the discharge tube inside on the inside~~ surface,[[.]] ~~Therefore[[.]]~~ much of the energy nearby around the axis in the discharge tube will be depleted and transfer wastefully converted into heat~~[[.]].~~ ~~Therefore,~~ the power transfer conversion factor of the lumen ~~needs to be improved~~ leaves some room for improvement.

Please replace paragraph [0034] with the following amended paragraph:

[0034] According to FIG. 2, the first tube 10 is a round straight glass tube~~[[.]]~~ which is the inner most tube in the multi tube fluorescent discharge lamp and are where the cathodes 26 located positioned at the innermost part of the multi-tube fluorescent discharge lamp. It is where the cathodes 26 as shown in FIG. 1 are to be inserted.

Please replace paragraph [0035] with the following amended paragraph:

[0035] According to FIG.3, ~~to use as a flame of gas and oxygen or are heating around the circumference in the vicinity of the middle of the first tube 10 for softening and is rotated in the reverse direction around both ends of the tube, and is twisted at the softening place thus fusing into an isolator 12 to seal the pipeline nearby the middle of the tube to insulate toward the middle of the first tube 10, the glass is softened by heating with a flame of gas and oxygen or by means of an arc heating. It is twisted at the softened middle part by turning around the two ends of the tube in mutually reverse direction. Thus an isolator 12 is formed, and the pipeline of the tube is blocked at the middle, insulating and separating the discharge path of the first tube 10 into two discharge chambers.~~

Please replace paragraph [0036] with the following amended paragraph:

[0036] According to FIG.4, ~~blowing the air in from both ends of the first tube 10, also heating is performed nearby both ends of isolator 12 on the two circumferences at the position of plural number thus the through hole 14 of plural number~~ air is blown into the first tube 10 from both ends, and heating is performed at several points around the two sides of the isolator 12. This way, the plural-numbered through-holes 14 are formed.

Please replace paragraph [0037] with the following amended paragraph:

[0037] According to FIG.5, the second tube 16 is a round straight glass tube ~~of which the whose~~ diameter is slightly larger than that of the first tube 10~~[[.]].~~ ~~at one~~ One end of the second tube 16 is air tight, and ~~[[the]]~~ air is blown in either from another the other end[[.]] or

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

~~air is blown in from both ends[[,]]. [[also]] Also, heating is performed nearby both ends on the two circumferences at the position of plural number thus the through hole 14 of plural number~~ at several spots around both ends of the tube, and the plural-numbered through-holes 14 are formed.

Please replace paragraph [0038] with the following amended paragraph:

[0038] According to FIG.6, the first tube 10[[,]] ~~after passing through the holes, is slid into the second tube 16 in coaxial structure then heating on the circumference of the second tube 16 correspond to the position of isolator 12 of the first tube 10, also, rotation is made with reverse direction at both ends of the second tube 16, and is twisted at the softening place of the tube thus fusing into another isolator 12 with the first tube 10 to seal~~ is slid into the second tube 16 to form a coaxial structure. Heating is performed around the second tube 16, at a place that corresponds to the position of the isolator 12 in the first tube 10, and then rotation is made at both ends of the second tube 16 in mutually reverse direction. This way, the heated, softened middle part of the tube is fused with the first tube 10 into another isolator 12 that blocks the pipeline of the second tube 16 and separating the discharge path of the second tube 16 into two discharge chambers.

Please replace paragraph [0039] with the following amended paragraph:

[0039] ~~According to FIG.7, phosphor layer 18 is coated on the inner and outer layer~~ FIG. 7 demonstrates how the inner and outer surface of the first tube 10 and the second tube 16 are coated with the phosphor layer 18.

Please replace paragraph [0040] with the following amended paragraph:

[0040] According to FIG.8, the third tube 20 is a round straight glass tube ~~of which the~~ whose diameter is slightly larger than that of the second tube 16, and the phosphor layer 18 is coated on the inner layer surface of the third tube 20.

Please replace paragraph [0041] with the following amended paragraph:

[0041] According to FIG.9, ~~this combination the assembly of the first tube 10 and the second tube 16 can be slid~~ is inserted into the third tube 20 ~~[[in]]~~ to form a coaxial structure.

Please replace paragraph [0042] with the following amended paragraph:

[0042] According to FIG.10 and refer to ~~[[the]]~~ FIG.6[[,]]. After the assembly ~~just as the combination of the first tube 10 and the second tube 16 to be~~ is slid into the third tube 20 ~~[[in]]~~ to form a coaxial structure, ~~that the diameter of the third tube 20, with its diameter which is slightly larger than that of the second tube 16, heating is performed on the circumference of the third tube 20 correspond~~ is heated around a site that corresponds to the isolator 12 of the

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

second tube 16[.]. Then, rotation is performed also, ~~rotation is made with reverse direction~~ at both ends of the third tube 20 ~~and is twisted at the softening place in mutually reverse direction, and the softened part of the third tube 20 for fusing is fused with the isolator 12 of the second tube 16[.], into another then to connect and form an isolator 12 that blocks the pipeline of the third tube 20 to seal the pipeline of the third tube 20 and separate the discharge path of the third tube 20[.].~~ Next, ~~air is allowed in from to allow the air being blown in at both ends of the third tube 20, also, heating shall be is performed on the circumference at both ends of 20 to approach third tube 20 around several points at both sides of the isolator 12 of the second tube 16, and the plural-numbered at the position of plural number thus the through-hole 14 with plural number are formed.~~

Please replace paragraph [0043] with the following amended paragraph:

[0043] The assembly ~~Also, with a glass tube of the fourth tube 22, which the diameter is slightly larger than that of the third tube 20, to slide into the combination of the first tube 10, the second tube 16, and the third tube 20, is then slid into the fourth glass tube 22, one with a diameter slightly larger than that of the third tube 20 to form a [in] coaxial structure[.].~~ heating ~~Heating is also performed on the circumference of the fourth tube 22 around the area that approaches approach to the isolator 12 of the third tube 20[.]. The two at both ends of [said] the fourth tube 22 are turned around in mutually is rotated in reverse direction, and the softened part twisted at the softening place of the fourth tube 22 for fusing is twisted and fused with the isolator 12 of the third tube 20 for connecting and forming an into another isolator 12 that blocks the pipeline of the fourth tube 22 to seal the pipeline and divides the discharge path of the fourth tube 22[.] separating the discharge path of the fourth tube 22, thus forming into two discharge chambers so that air can be blown in from both ends of the fourth tube 22, [also] Moreover, heating is performed on the circumference to approach around several spots at both ends of the fourth tube 22 and at the position of plural number, thus extruding producing plural-numbered through-holes 14 with plural number.~~

Please replace paragraph [0044] with the following amended paragraph:

[0044] The phosphor layer 18 is formed ~~at the inner and outer layer surface of the combination on both the inside and outside surfaces of the assembly of the first tube 10, the second tube 16, the third tube 20 and the fourth tube 22[.]. It can also be found on the inside also formed at the inner layer surface of the fifth tube 24. This connected combination The assembly of the first tube 10, the second tube 16, the third tube 20 and the fourth tube 22, is to be inserted shall be slid into the fifth tube 24 [in] to form a coaxial structure.~~

Please replace paragraph [0045] with the following amended paragraph:

[0045] According to FIG.11, ~~one stem 34 is a conical glass post, one of its ends with smaller diameter can seal and fix the plural electrode 28 which is connected with a straight form~~

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

~~eachode 26, one pipe 32 is connected with the sealed end of the fixed plural electrode 28, its opening hole 30 is located the sealed end and communicated with the stem 34 is a hollow conical glass post with two ends of different diameters. Its smaller end can seal and fix the electrode 28, which is attached to a straight cathode 26. The pipe 32 is connected with the stem 34, and its opening hole 30 is located at the sealed end of the electrode 28 and allows exhaust to pass through the pipe 32.~~

Please replace paragraph [0046] with the following amended paragraph:

[0046] According to FIG.12, and refer to [[the]] FIG.11[[,]]. [[the]] The electrodes 28 which is connected with a ring cathode 38.

Please replace paragraph [0047] with the following amended paragraph:

[0047] According to FIG.13, ~~a cap 36 its~~ the inner diameter of the cap 36 is same as the outer diameter of the first tube 10, and the outer diameter of cap 36 is the same as identical to the diameter of the outermost outermost discharge tube.

Please replace paragraph [0048] with the following amended paragraph:

[0048] According to FIG.14, the structure of the stem is the same as that illustrated in FIG.11, but the larger end of the conical glass post is connected with the cap 36, the outer diameter of which is identical to above, however, for the conical glass post, the larger end is connected with a cap 36, the outer diameter of said the cap 36 is the same as the diameter of the outermost outermost tube of the multi-tube fluorescent discharge lamp.

Please replace paragraph [0049] with the following amended paragraph:

[0049] ~~According to FIG.15 and refer to the FIG.14, the structure same as FIG.14, however, its electrodes 28 is connected with a ring cathode 38. Compare FIG. 15 with FIG. 14. The structure is identical, but the electrode 28 in FIG. 15 is connected with the ring cathode 38.~~

Please replace paragraph [0050] with the following amended paragraph:

[0050] ~~According to FIG.16 and refer to the FIG.9, also including plural number stem 34, said stem 34 includes a cathode 26, plural~~ Take a look at FIG. 16 and FIG. 9. FIG. 16 also has a pair of stems 34, which includes a cathode 26 and the paired electrode 28, and which connects with a cap 36[[,]]. The said cathode 26 is assembled in each of the two discharge chamber chambers of the first tube 10, respectively[[,]] The [[the]] outer diameter of the cap 36 is the same as that of the third tube 20.

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

Please replace paragraph [0051] with the following amended paragraph:

[0051] ~~According to FIG.17 and refer to the FIG.16, the cathode 26 of plural number stem 34 are slid into the two discharge chambers of the first tube 10 respectively, heating at the outskirts of the circumference at both ends of all the tubes, melting and sealing both ends of the tubes. See FIG. 17 and refer to FIG.16. A stem 34 with the cathode 26 is inserted into each of the two discharge chambers of the first tube 10. The outskirts of both ends of all the assembled tubes are heated and melted together, sealing both ends of the tubes.~~

Please replace paragraph [0052] with the following amended paragraph:

[0052] ~~Or use the cathode 26 of plural number stem 34 with cap 36 is slid into the two discharge chambers of the first tube 10 respectively, heating on the circumferences of cap 36 correspond to the both ends of all the tubes, and at both ends of all the tubes can be melted and sealed. Due to the sealing of both ends of all discharge tubes and isolator 12 and through-hole 14 of the first tube 10 and the second tube 16, thus, forming successive discharge chambers. Alternatively, the cathode 26 with a pair of stems 34 linked with the cap 36 can be slid into each of the two discharge chambers of the first tube 10. Heating is performed on the cap 36, which is attached to the ends of all the tubes, so the two ends of all the tubes can be melted together and sealed. The sealing of the ends of all discharge tubes, together with the isolator 12 and the through-holes 14 of the first tube 10 and the second tube 16, forms a succession of interconnected discharge chambers.~~

Please replace paragraph [0053] with the following amended paragraph:

[0053] According to FIG.18, the first tube 10 is a round straight glass tube, in which a pair of electrodes 28 and one pipe 32 with the said tube are ~~slid in~~ inserted to form a coaxial structure[.]. ~~and heating at one~~ One end of the first tube is heated for softening, by means of clamping, pressing and sealing the tube, the pair of electrodes 28 and pipe 32 can be fixed, air is blown into the pipe 32, by means of the heating at the end of sealed, a hole 30 can be extruded, forming a phosphor layer 18 on the surface of said tube outside, install cathode 26 in the pair of electrode 28, and the other first tube 10 can be completed with the method mentioned above. ~~and then clamped, pressed and sealed. The pair of electrodes 28 and the pipe 32 can be fixed, and air is blown into the pipe 32. By heating the sealed end, a hole 30 can be produced for exhaust to pass through the pipe 32. A phosphor layer 18 is applied on the outside surface of the said tube, and the cathode 26 is installed onto the pair of electrodes~~

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

28. At the other end of the assembly, the same process is to be performed on the other first tube 10.

Please replace paragraph [0054] with the following amended paragraph:

[0054] The second tube 16 is a round straight glass tube[,]] [[its]] with a diameter [[is]] slightly larger than that of the first tube 10, [[the]] [[air]] Air is blown in [[at]] from both ends of the second tube 16, or one end of the said tube is air tight and [[the]] air is blown in from another the other end[.]]. ~~also, heating~~ Heating is performed ~~on the circumferences to approach both ends of the second tube 16, at the position of plural number thus extruding the through hole 14 with plural number, and heating is also performed at the circumference to approach the middle of the second tube 16, rotated with reverse direction at both ends of the second tube, and is twisted at the softening place of the tube thus fusing into an isolator 12 to seal around several spots on both ends of the second tube 16, thus producing the plural-numbered through-holes 14.~~ The second tube 16 is also heated toward the middle part, and both ends are rotated in mutually reverse direction so that the tube is twisted in the middle, where it is fused into an isolator 12 that blocks the path of the discharge tube and separate the discharge path of the second tube 16.

Please replace paragraph [0055] with the following amended paragraph:

[0055] The third tube 20 is a round straight glass tube[,]] with its diameter [[is]] slightly larger than that of the second tube 16[.]]. [[the]] The phosphor layer 18 is formed [[in]] on the inner layer surface of the third tube 20 and [[in]] also on the inner and outer layer surfaces of the second tube 16.

Please replace paragraph [0056] with the following amended paragraph:

~~[0056] The two cathodes 26 of the first tubes 10 can be slid into the two discharge chamber of the second tube 16 in coaxial structure respectively, that the cathodes 26 installed oppositely to approach the isolator 12, heating at the outskirts of the circumference at both ends of the first tube 10 and the second tube 16, sealing both ends of the tubes, then slid into the third tube 20 in coaxial structure, heating at the outskirts of the circumference at both ends of the second tube 16 and the third tube 20, sealing both ends of all discharge tubes. Due to the sealing of both ends of all discharge tubes and isolator 12 and through hole 14 of the second tube 16, thus, forming successive discharge chambers. The cathode 26 of the first tube 10 can be slid into each of the two discharge chambers of the second tube 16 to form a coaxial structure. The two cathodes 26 are installed near the two sides of the isolator 12. Heating is performed at the outskirts of the two ends of the first tube 10 and the second tube~~

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

16, thus sealing both ends of the tubes. Then it is slid into the third tube 20 to form a coaxial structure, and heating is also performed at the outskirts of both ends of the second tube 16 and the third tube 20 in order to seal both ends of all discharge tubes. The sealing of both ends of all discharge tubes, along with the isolator 12 and the through-holes 14 of the second tube 16, form a succession of interconnected discharge chambers.

Please replace paragraph [0057] with the following amended paragraph:

[0057] As mentioned above, heating at the outskirts of the circumference at both ends of the first tube 10, the second tube 16, the third tube 20 can make it soft and melt and seal both ends of all discharge tubes, also, a cap 36 can be placed at both ends of the multi tube, after the cap 36 on the circumferences correspond to the both ends of all discharge tubes is heated, both ends of the first tube 10, the second tube 16, the third tube 20 can be melted and sealed, thus, forming successive discharge chambers. both ends of the first tube 10, the second tube 16, and the third tube 20, can soften, melt, and seal both ends of all of the discharge tubes. Also, a cap 36 that fits in with the two ends of all discharge tubes can be attached to each end of the multi-tube structure. By heating the cap 36, the ends of the first tube 10, the second tube 16, and the third tube 20 can be melted and sealed, thus forming a succession of interconnected discharge chambers.

Please replace paragraph [0058] with the following amended paragraph:

[0058] For the multi tube fluorescent discharge lamp with more than 5 tubes, which can be formed by means of the method mentioned above with the total tube number N (N= odd number), tube number of different tube with different diameter, the isolator 12 can be formed from the second tube 16 to the (N-1)th tube to approach the middle of the tubes. The through-hole 14 with plural number can be formed at the even number tube and from the second tube 16 to the (N-1)th tube to approach the both ends of the tubes at the position of circumference, the through-hole 14 with plural number can be formed at the odd number tube from third tube 20 to (N-2)th tube to approach the both ends of the isolator 12 at the position of circumference. Assemblies with more than 5 tubes can be formed with the method mentioned above. Suppose the number of total tubes is N (N is an odd number), and each tube has a different diameter from the others. The isolator 12 can be formed around the middle that extends from the second tube 16 to the (N-1)th tube. The plural-numbered through-holes 14 can be formed around the ends of the even-numbered tubes from the second

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

tube 16 to the (N-1)th tube, and also on both sides of the isolator 12 on the odd-numbered tubes from the third tube 20 to the (N-2)th tube.

Please replace paragraph [0059] with the following amended paragraph:

[0059] In there, the [[The]] phosphor layer 18 is coated on the inner and outer layer surface of the [[tube]] tubes from the second tube 16 to the (N-1)th tube, and coated on the outer [[layer]] surface of the tube on the first tube 10, and coated also on the inner [[layer]] surface of the Nth tube[[,]]. [[a]] A pair of electrode 28 [[of]] on the cathode 26 is connected with terminals 42 on the base 40 at each end connecting to terminal 42 of base 40 respectively.

Please replace paragraph [0060] with the following amended paragraph:

[0060] According to FIG.19, the first tube 10 is a round straight glass tube[[,]]. Heating is performed at the circumference to approach toward the middle of the first tube 10, and rotation is made with reverse direction at both ends of the first tube 10[[,]] in mutually reverse direction. and is twisted at the softening place of the tube thus fusing into an isolator 12 to seal the pipeline of the first tube 10, thus, forming two discharge chambers, and air is blown in from both ends of said tube and heating is performed at the circumferences approach to the both ends, at the position of plural number to extrude the through hole 14 with plural number, forming the phosphor layer 18 on the inner and outer layer. The softened part of the tube is twisted and fused into an isolator 12 that blocks the pipeline of the first tube 10 and forms two discharge chambers. Then, air is blown in from both ends of the said tube and heating is performed at several spots around the ends, resulting in the plural-numbered through-holes 14. A phosphor layer 18 is formed on the outer surface of said tube.

Please replace paragraph [0061] with the following amended paragraph:

[0061] A second tube 16 is a round straight glass tube of which the diameter is slightly larger than that of the first tube 10, the phosphor layer 18 is coated on the inner layer surface of the second tube 16, then the first tube 10 be slid into the second tube 16 in coaxial structure, also, plural number stem 34, said stem 34 includes a cathode 26, a pair of electrode 28, a hole 30, a pipe 32, its plural number cathode 26 is placed in the two discharge chambers of the first tube 10. Heating is performed at the outskirts of circumference at both ends of the first tube 10 and the second tube 16 to melt and seal both ends of the first tube 10 and the second tube 16 with the stem 34, due to the isolator 12 and the through hole 14 of the first tube 10, and the sealing of both ends of all discharge tubes, thus, forming successive discharge chambers. with a diameter slightly larger than that of the first tube 10 and a phosphor layer on the inner surface of the second tube 16. The first tube 10 is slid into the second tube 16 to form a coaxial structure. Besides, a pair of stems 34 is structured with a cathode 26, a pair of electrodes 28, a hole 30, and a pipe 32. Each of the two discharge chambers of the first tube 10 contains a

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

cathode 26. Heating is performed at the outskirts of both ends of the first tube 10 and the second tube 16 so as to melt and seal both ends of the first tube 10 and the second tube 16 together with the stem 34. The isolator 12, the through-holes 14 of the first tube 10, and the sealing of both ends of all discharge tubes conspire to form a succession of interconnected discharge chambers.

Please replace paragraph [0062] with the following amended paragraph:

[0062] ~~For the multi-tube fluorescent discharge lamp with 4 tubes or more than 4 tubes, which can be formed by means of the method mentioned above with the total tube number N (N= even number), tube number of different tube with different diameter, the isolator 12 can be formed from the first tube 10 to the (N-1)th tube to approach the middle of the tubes. The through hole 14 with plural number can be formed at the odd number tube and from the first tube 10 to the (N-1)th tube to approach the both ends of the tubes at the position of circumference, the through hole 14 with plural number can be formed at the even number tube from the second tube 16 to (N-2)th tube to approach the both ends of the isolator 12 at the position of circumference, also, with one cap 36 or the stem 34 connecting a cap 36 at both ends of the multi-tube to heat the cap 36 at the circumferences of both ends of the corresponding discharge tubes, both ends of all tubes can be melted and sealed, the phosphor layer 18 coated on the inner and outer layer surface of the tube from the second tube 16 to the (N-1)th tube, and coated on the outer layer surface of the first tube 10, and coated on the inner layer surface of the Nth tube, a pair of electrode 28 of the cathode 26 connecting to terminal 42 of base 40 respectively. Assemblies with more than 4 tubes can be formed with the method mentioned above. Let's say the number of total tubes is N (N is an even number), and each tube has a different diameter from the others. The isolator 12 can be formed around the middle that extends from the first tube 10 to the (N-1)th tube. The plural-numbered through-holes 14 can be formed on both sides of the isolator 12 on the odd-numbered tubes from the first tube 10 to the (N-1)th tube, and also around the ends of the even-numbered tubes from the second tube 16 to the (N-2)th tube. Also, a cap 36 on the stem 34 is attached to each end of the multi-tube, and heating is performed on the spots of the cap 36 that meet the assembled discharge tubes. This way, both ends of all the tubes can be melted and sealed. Therein, the phosphor layer 18 is applied on the inner and outer surfaces of the tubes from the second tube 16 to the (N-1)th tube, on the outer surface of the first tube 10, and also on the inner surface of the Nth tube. A pair of electrodes 28 on the cathode 26 is connected to terminals 42 on the base 40 at each end.~~

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

Please replace paragraph [0063] with the following amended paragraph:

[0063] ~~According to FIG.20 and refer to the FIG.10, also including plural number stem 34, said stem 34 includes a cathode 26, a pair of electrode 28, and connects with one cap 36, said cathode 26 is assembled in the two discharge chambers of 10, the outer diameter of the cap 36 is the same as that of the third tube 20. The cathode 26 of plural number stem 34 is assembled in the two discharge chambers of the first tube 10 respectively, heating is performed at the outskirts of the circumference correspond to the both end of all tubes, its softening can melt and seal both ends of all tubes or plural number stem 34 connecting with cap 36 placed at both ends of the first tube 10, the second tube 16, the third tube 20, the fourth tube 22 and the fifth tube 24, heating on the corresponding position at the circumference of all discharge tubes of the two caps 36 can seal both ends of all tubes. Due to the isolator 12, the through hole 14 and sealing of both ends of all discharge tubes, thus, forming successive discharge chambers. Refer to FIG. 20 FIG. 10. The pair of stems 34 in FIG. 20 is structured with a cathode 26, a pair of electrodes 28, and a cap 36. The cathode 26 is assembled in each of the two discharge chambers of the first tube 10. The outer diameter of the cap 36 is the same as that of the fifth tube 24. The cap 36 is attached to each end of the first tube 10, the second tube 16, the third tube 20, the fourth tube 22, and the fifth tube 24. Heating at the points where the two caps 36 meet all of the discharge tubes can seal both ends of all the tubes. With the isolator 12, the through-holes 14, and the sealing of both ends of all the discharge tubes, a succession of interconnected discharge chambers can be formed.~~

Please replace paragraph [0064] with the following amended paragraph:

[0064] ~~For the multi-tube fluorescent discharge lamp with more than 5 tubes, which can be formed by means of the method mentioned above with the total tube number N (N= odd number), tube number of different tube with different diameter, the isolator 12 can be formed from the first tube 10 to the (N-1)th tube to approach the middle of the tubes. The through-hole 14 with plural number can be formed at the even number tube and from the second tube 16 to the (N-1)th tube to approach the both ends of the tubes at the position of circumference, the through hole 14 with plural number can be formed at the odd number tube from the first tube 10 to the (N-2)th tube to approach the both ends of the isolator 12 at the position of circumference, the phosphor layer 18 coated on the inner and outer layer surface of the tube form the first tube 10 to the (N-1)th tube, and the inner layer surface of the Nth tube, a pair of electrode 28 of the cathode 26 connecting to terminal 42 of base 40 respectively. Assemblies with more than 5 tubes can be formed with the method mentioned above. Let's say the~~

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

number of total tubes is N (N is an odd number), and each tube has a different diameter from the others. The isolator 12 can be formed around the middle that extends from the first tube 10 to the (N-1)th tube. The plural-numbered through-holes 14 can be formed around the ends of the even-numbered tubes from the second tube 16 to the (N-1)th tube, and also on both sides of the isolator 12 on the odd-numbered tubes from the first tube 10 to the (N-2)th tube. Therein, the phosphor layer 18 is applied on the inner and outer surfaces of the tube from the first tube 10 to the (N-1)th tube, and also on the inner surface of the Nth tube. A pair of electrodes 28 on the cathode 26 is connected to terminals 42 on the base 40 at each end.

Please replace paragraph [0065] with the following amended paragraph:

[0065] According to FIG. 21 and refer to the FIG. 17, one base 40 with a pair of terminal 42 at both ends of the three tube fluorescent discharge lamp, the electrode 28 of the cathode welded on said terminal 42 respectively. Compare FIG. 21 with FIG. 17. A base 40 with a pair of terminals 42 is attached to each of the two ends of the three-tube fluorescent discharge lamp. The electrodes 28 of the cathode 26 are welded to the said terminals 42 one to one.

Please replace paragraph [0066] with the following amended paragraph:

[0066] According to FIG. 22, when negative HV presents at one of those electrode 26 in the first discharge tube 10, electrons released by its electrode are attracted by positive HV at another electrode 26 in another first discharge tube 10, for moving into second discharge tube 16 from through hole 14 of the first discharge tube 10, via the third discharge tube 20 from through hole 14 of the second discharge tube 16; electrons passing through the third discharge tube 20 enter into another end of second discharge tube 16 from through hole 14 thereof, and into another end of the first discharge tube 10 from through hole 14 thereof, then the electrons hit another electrode 26; the electrode 26 with positive charges are converted into negative charges during the next half cycle of the alternating current, with negative charges in said another end of discharge tube 10, to release the electrons traveling in reverse along the route of electron movement of the first half cycle to repeat the process upon arriving at the corresponding electrode 26 with positive charges during which electronic ions and ultraviolet excited by the discharge chamber of each discharge tube, the phosphor on the surface of each discharge tube will be impacted and to emit light. As illustrated in FIG. 22, when negative HV is present at one of the electrodes 26 in one side of the first discharge tube 10, electrons released from the electrode are attracted by the positive HV at the other electrode 26 in the other side of the first discharge tube 10. The electrons move into the

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

second discharge tube 16 via the through-holes 14 of the first discharge tube 10, and then travel into the third discharge tube 20 via the through-holes 14 of the second discharge tube 16. The electrons that pass through the third discharge tube 20 will enter the second discharge tube 16 at the other end via the through-holes 14 of the second discharge tube, and go on into the adjacent first discharge tube 10 via the through-holes 14 of the first discharge tube 10. Here, the electrons hit the other electrode 26. The positive of the electrode 26 are converted into negative ones during the next half cycle of the alternating current. At the other end of the discharge tube 10 with negative, the released electrons travel in the same manner, but in reverse direction, along the route of the electron movement in the first half cycle, and arrive in time at the counterpart electrode 26 with positive charges. Meanwhile, the electronic ions and ultraviolet rays are excited by the discharge chambers of each discharge tube, causing the phosphor on the surface of each discharge tube to emit light.

Please replace paragraph [0067] with the following amended paragraph:

~~[0067] According to FIG.23, when negative HV presents at one of those electrode 26 in the first discharge tube 10, electrons released by its electrode are attracted by positive HV at another electrode 26 in another first discharge tube 10, for moving into second discharge tube 16 from through hole 14 of the first discharge tube 10, via the third discharge tube 20 from through hole 14 of the second discharge tube 16, then fourth discharge tube 22 from through hole 14 of the third discharge tube 20 and finally into the fifth discharge tube 24 from through hole 14 of fourth discharge tube 22; electrons passing through the fifth discharge tube 24 enter into another end of fourth discharge tube 22 from through hole 14 thereof, then into another end of third discharge tube 20 from through hole 14 thereof and into another end of second discharge tube 16 from through hole 14 thereof reaching another end of the first discharge tube 10 from through hole 14 thereof, then the electrons hit another electrode 26; the electrode 26 with positive charges are converted into negative charges during the next half cycle of the alternating current, with negative charges in said another end of discharge tube 10, to release the electrons traveling in reverse along the route of electron movement of the first half cycle to repeat the process upon arriving at the corresponding electrode 26 with positive charges during which electronic ions and ultraviolet excited by the discharge chamber of each discharge tube, the phosphor on the surface of each discharge tube will be impacted and to emit light. Similarly in FIG. 23, when negative HV is present at one of the electrodes 26 in one side of the first discharge tube 10, the electrons released from the electrode are attracted by the positive HV at the other electrode 26 in the other side of the~~

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

first discharge tube 10. The electrons move into the second discharge tube 16 via the through-holes 14 of the first discharge tube 10, next travel into the third discharge tube 20 via the through-holes 14 of the second discharge tube 16, then into the fourth discharge tube 22 by way of the through-holes 14 of the third discharge tube 20, and finally into the fifth discharge tube 24 by passing the through-holes 14 of the fourth discharge tube 22. The electrons that passing through the fifth discharge tube 24 will enter the fourth discharge tube 22 at the other end via the through-holes 14 of the fourth discharge tube 22, then into the adjacent third discharge tube 20 from the through-holes 14 of the third discharge tube 20, next into the neighboring second discharge tube 16 via the through-holes 14 of the second discharge tube 16, and finally reaching the hugging first discharge tube 10 from the through-holes 14 of the first discharge tube 10. Here, the electrons hit the other electrode 26. The positive charges of the electrode 26 are converted into negative during the next half cycle of the alternating current. At the other end of the discharge tube 10 with negative, the released electrons travel in the same manner, but in reverse direction, along the route of the electron movement in the first half cycle, and arrive in time at the counterpart electrode 26 with positive. During this process, electronic ions and ultraviolet rays are excited by the discharge chambers of each discharge tube, causing the phosphor on the surface of each discharge tube to emit light.

Please replace paragraph [0068] with the following amended paragraph:

~~[0068] According to FIG. 24, at the related positions between all discharge tubes, the isolator 12 formed at the first tube and second tube to approach the middle of these tubes, the cathode 26 is located in the discharge chambers of the first tube 10 respectively. Forming through-hole 14 with plural number at the circumference to approach the both ends of the isolator 12 of the first tube 10, forming through hole 14 with plural number at the circumference to approach the both ends of the second tube 16. The phosphor layer 18 coated on the inner and outer layer surface of the first tube 10, the second tube 16 and the inner layer surface of the third tube 20, a pair of electrode 28 of the cathode 26 connecting to terminal 42 of base 40 respectively. FIG. 24 shows the relative positions of all the discharge tubes. The isolator 12 is formed near the middle across the first tube and the second tube. The cathode 26 is located in each of the two discharge chambers of the first tube 10. The plural-numbered through-holes 14 are formed around both sides of the isolator 12 of the first tube 10 and at both ends of the second tube 16. The phosphor layer 18 is coated on the inner and outer surfaces of the first tube 10 and the second tube 16, and also on the inner surface of the third tube 20. The~~

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

paired electrodes 28 on the cathode 26 are connected with the terminals 42 on the base 40 at each end of the tube.

Please replace paragraph [0069] with the following amended paragraph:

[0069] ~~According to FIG. 25, at the related positions between all discharge tubes, the isolator 12 formed at the first tube 10, the second tube 16, the third tube 20 and fourth tube 22 to approach the middle of these tubes, the cathode 26 is located in the discharge chambers of the first tube 10 respectively. Forming through hole 14 with plural number at the circumference to approach the both ends of the isolator 12 of the first tube 10 and the third tube 20, forming through hole 14 with plural number at the circumference to approach the both ends of forming through hole 14 with plural number the second tube 16 and fourth tube 22. The phosphor layer 18 coated on the inner and outer layer surface of the first tube 10, the second tube 16, the third tube 20, the fourth tube 22, and the inner layer surface of the fifth tube 24, a pair of electrode 28 of the cathode 26 connecting to terminal 42 of base 40 respectively. FIG. 25 demonstrates a similar, though more complex, mapping of the relative positions of all the discharge tubes. The isolator 12 is formed near the middle across the first tube 10, the second tube 16, the third tube 20, and fourth tube 22. The cathode 26 is located in each of the discharge chambers of the first tube 10. The plural-numbered through-holes 14 are formed around both sides of the isolator 12 of the first tube 10 and of the third tube 20. Other plural-numbered through-holes 14 are created around both ends of the second tube 16 and of the fourth tube 22. The phosphor layer 18 is applied on the inner and outer surfaces of the first tube 10, the second tube 16, the third tube 20, and the fourth tube 22, and also on the inner surface of the fifth tube 24. A pair of electrodes 28 on the cathode 26 are connected with the terminals 42 on the base 40 at each end of the multi-tube.~~

Please replace paragraph [0070] with the following amended paragraph:

[0070] ~~Subsequently, Heating on outside of the combination of tubes; meanwhile, blowing in dry air from one of the pipe 32 and exhausted from the other pipe 23, to accelerate drying the phosphor layers. After the drying process completed, one of the pipe 23 is heated and sealed; then several mg of mercury (Hg) is injected into the discharge chamber from the opening pipe 32, then the discharge chamber is vacuumed and then filled with little of Ar gas such as several hundreds Pa in pressure, and then sealing the pipe 23. Afterward the combination of tubes is put in an environment of electromagnetic field such as microwave chamber to agitate the liquid Hg into vapor Hg, applying current and high voltage on the both cathodes, a glow~~

Appl. No. 09/681,524
Amdt. dated 09/14/2003
Reply to Office action of 03/14/2003

discharge will be generated in the discharge lamp. the assembly of tubes is heated on the outside. Meanwhile, dry air is blown in from the pipe 32 at one end and exits through the pipe 32 at the other end so as to accelerate the drying process of the phosphor layers. After the drying process is completed, one of the pipes 32 is heated and sealed, and then several mg of mercury (Hg) is injected into the discharge chambers from the other pipe 32. What follows, the discharge chambers are vacuumed and then filled with a little Ar gas, such as several hundred Pa in pressure. Then the pipe 32 is sealed. Afterwards, the assembly of tubes is placed in an electromagnetic environment, such as a microwave chamber, to agitate the liquid Hg into vapor Hg. After high-voltage currents go through the two cathodes, a radiating glow will be generated in the discharge lamp.